

Choosing A Water Heating System

An energy pundit once observed “Americans just want hot showers and cold beer.” That may be an oversimplification, but it’s hard to beat a hot shower. Available methods for making hot water have increased beyond electric or gas-fired water heaters and oil or gas boilers with immersed water heating coil. The added choices are essentially a response to increasing fuel costs the last several decades.

That is unlikely to change, so it’s worthwhile to carefully consider the options.

The first strategy is to reduce the load, just as we reduce the heating load of our houses before selecting the heating system. Low flow fixtures and horizontal axis washing machines make a big dent in hot water use. Sending your teenagers to another country is also a very effective conservation strategy.

We heat water either by burning a fuel (oil, gas, or biomass), using electricity, or with solar energy. At SMC, we have stopped installing fossil fuel appliances for heating our houses, as air source heat pumps (powered by electricity) have so many clear advantages. This means that using a gas or oil-fired boiler to heat water is no longer a good option. And we’ve learned through our monitoring efforts that in the warmer weather, when boilers are only heating water, they do so quite inefficiently. Once the fossil fuel heating system is off the table, it makes little sense to use gas to heat water only. On MV, gas means propane, not natural gas, and the cost of using propane to make hot water can easily equal or exceed using electricity for the job.

Many people ask us about another gas-fired approach to heating water called a demand water heater (or tankless or instantaneous). Without a tank, there’s no heat loss when the water isn’t being heated. Demand water heaters never run out of hot water, but are usually limited to supplying one or two showers simultaneously (and because demand water heaters need such a high power input, electric demand water heaters are out of consideration, except for small loads far from the central system). Another drawback is that demand water heaters need a minimum water flow rate to turn on, which can make them annoying to use at a bathroom sink, for example.

Driven by our goal of zero energy homes powered by solar electricity, we’ve looked carefully at using electricity to make hot water. In cases of low daily hot water usage, or very tight budgets, we turn to the most efficient electric water heater, the Marathon by Rheem. It has all plastic construction so is not susceptible to corrosion, and comes with a lifetime warranty. It has a lot of insulation, minimizing losses to the space around it.

A substantially more energy-efficient approach is the heat pump water heater (HPWH). Heat pumps are devices that move heat from a colder place to a warmer one. For example, a refrigerator is a heat pump, moving heat from the cold refrigerated compartment to the warmer room. This takes energy and heat pumps are powered by electricity. If a house has a basement with an unfinished portion, a HPWH can be installed that takes heat from the basement and puts it into the hot water. Most HPWHs have a back-up electrical heating element for times of high demand. HPWHs with large tanks, such as the 80 gallon Stiebel Eltron, use the back-up element less than HPWHs with 50 or 60 gallon tanks, so they use less energy overall. Most HPWHs have the heat pump built in on top of the tank, so they are quite tall. They will cool the basement slightly, along with providing some modest dehumidification (as heat is taken from the basement air, some of the moisture in the air is condensed out – a condensate pump is usually installed to pump the condensate to a drain.) We’ve found that the best HPWH, the Stiebel Eltron, makes almost three times as much hot water per unit of energy in as the best electric water heater. These things really work! The HPWH’s efficiency improves

in warmer surroundings, so they are a particularly good choice for a house used primarily in the warmer months, as the basement is warmer than in the winter, and the dehumidification is quite welcome. Because the HPWH is electrically-driven, it's a good match with solar electricity.

What if the water heating load is sizable, or if there is not a good location for a HPWH? The other energy-efficient option for making hot water is solar. We think of solar hot water when the hot water load is at least 50 gallons/day (10-15 gallons per person per day is a starting point for estimating), the occupancy of the house is year-round (or else there is a good place to use the energy when it's not occupied), and there is good solar exposure. In an existing home, we look for a clear path for the pipes from the roof to the storage tank location, and usually we add a tank just for the solar heated water, using it as a preheat. As with solar electric systems, there are tax credits on solar water heating systems, which helps to bring the cost down. Our most typical solar water heating system is two roof-mounted collectors roughly 4' x 8' in size. We use flat plate collectors rather than the more exotic evacuated tube collectors because they are less costly and perform equally well in the Vineyard climate.

The summary:

- Fossil fuels: make no sense
- Best bet: heat pump hot water heater
- When the heat pump won't fit, or won't satisfy the load: solar with Marathon electric.
- For budget houses: Marathon electric.

That's it for hot water, back to the cold beer!